Bus Futures

New Technologies for Cleaner Cities

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Why promote Alternative Fuel Vehicles (AFVs)?

- AFVs are commercially available today to replace diesel and gasoline
- AFVs offer immediate clean-air benefits, often reducing emissions of particulates and nitrogen oxides
- Replacing diesel with AFVs Reduces consumption of foreign oil
- Concerns over health impacts of diesel exhaust particulates
- Long-term benefits – pathway to hydrogen

Health impacts of diesel exhaust

- Suspected human carcinogen
  - 40+ compounds found to cause cancer or reproductive harm
  - Hazardous air pollutant (EPA)
  - Toxic air contaminant (Cal EPA)
- Known to trigger asthma attacks
- Contributes to premature deaths and increased respiratory illnesses

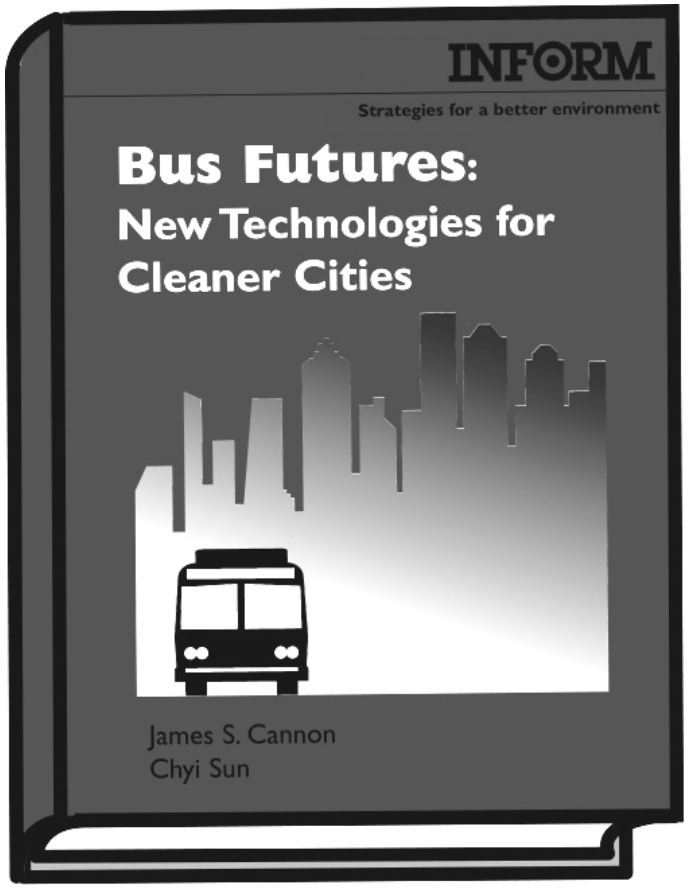
Cancer Risk Assessments for Diesel Exhaust Particulates

Organization	Classification	Year
U.S. EPA	Likely human carcinogen	1998
NTP	Reasonably anticipated to be a human carcinogen	1998
CARB	Toxic air contaminant	1998
IARC	Probable human carcinogen	1989
NIOSH	Potential occupational cancer	1988

Fleet Vehicles

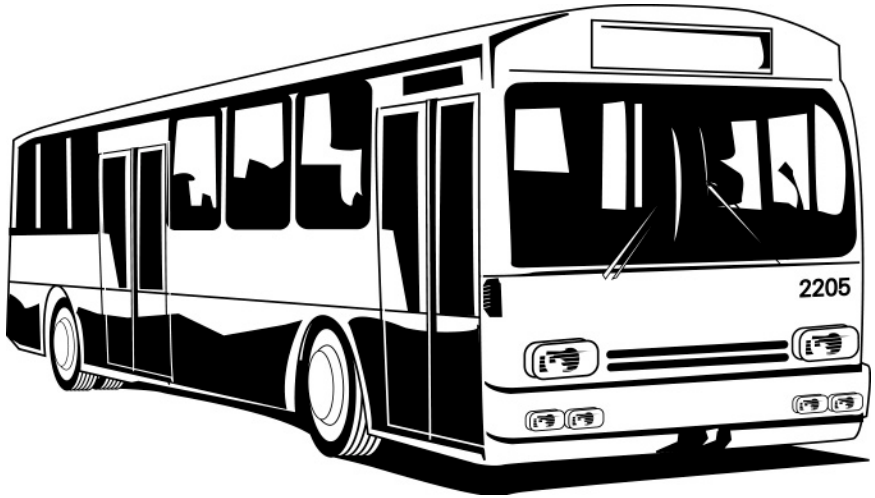
- INFORM is currently targeting heavy duty fleets for our research and outreach
  - Municipal Buses (*Bus Futures)*
  - School Buses
  - Waste Collection Vehicles

Transit Buses



- *Bus Futures* report released August 2000
- Primary conclusion: natural gas is the cleanest commercial technology for transit bus applications
- Enthusiastically received by public and private sectors, environmental and community groups

CNG Transit Buses



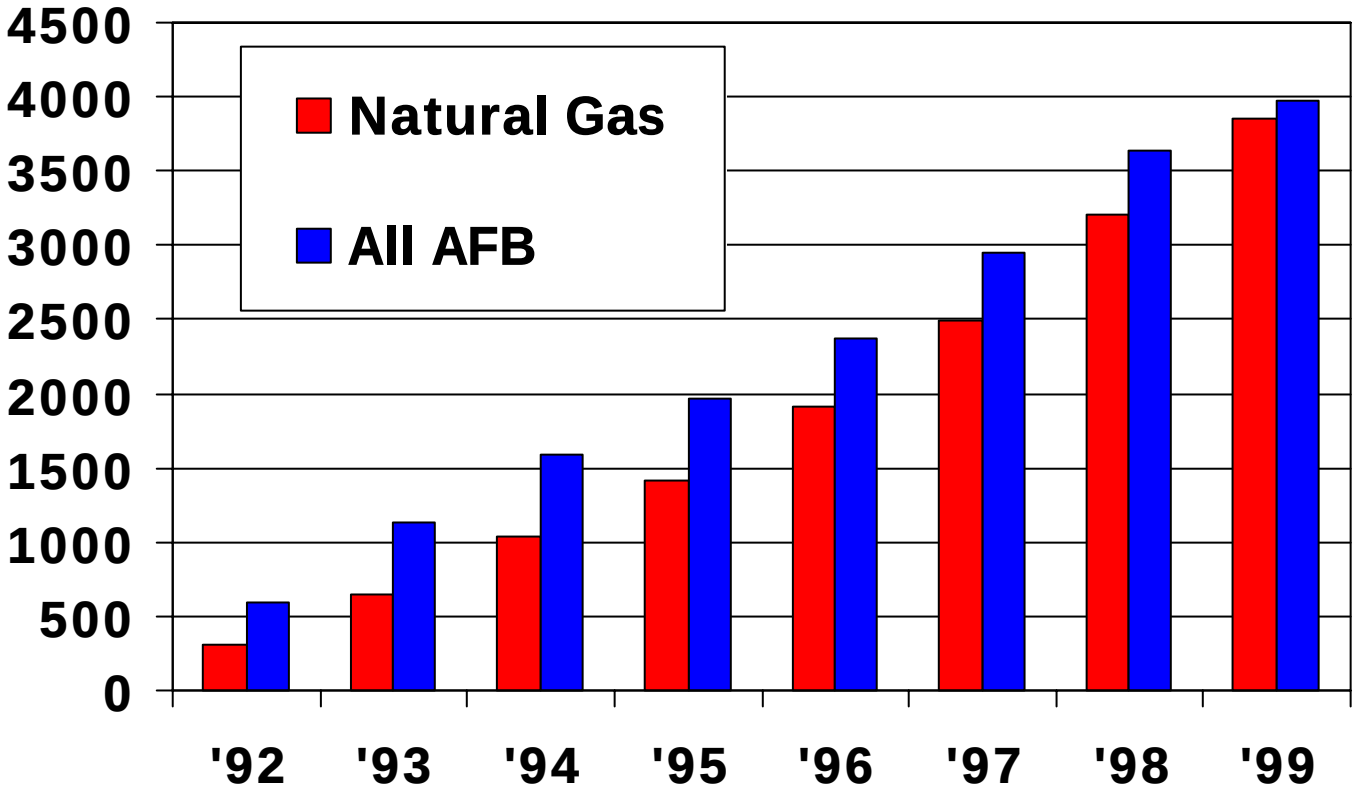
- Cleanest commercial available option today
- Emission Reductions:

  PM 40–86%

  NOx 38–65%

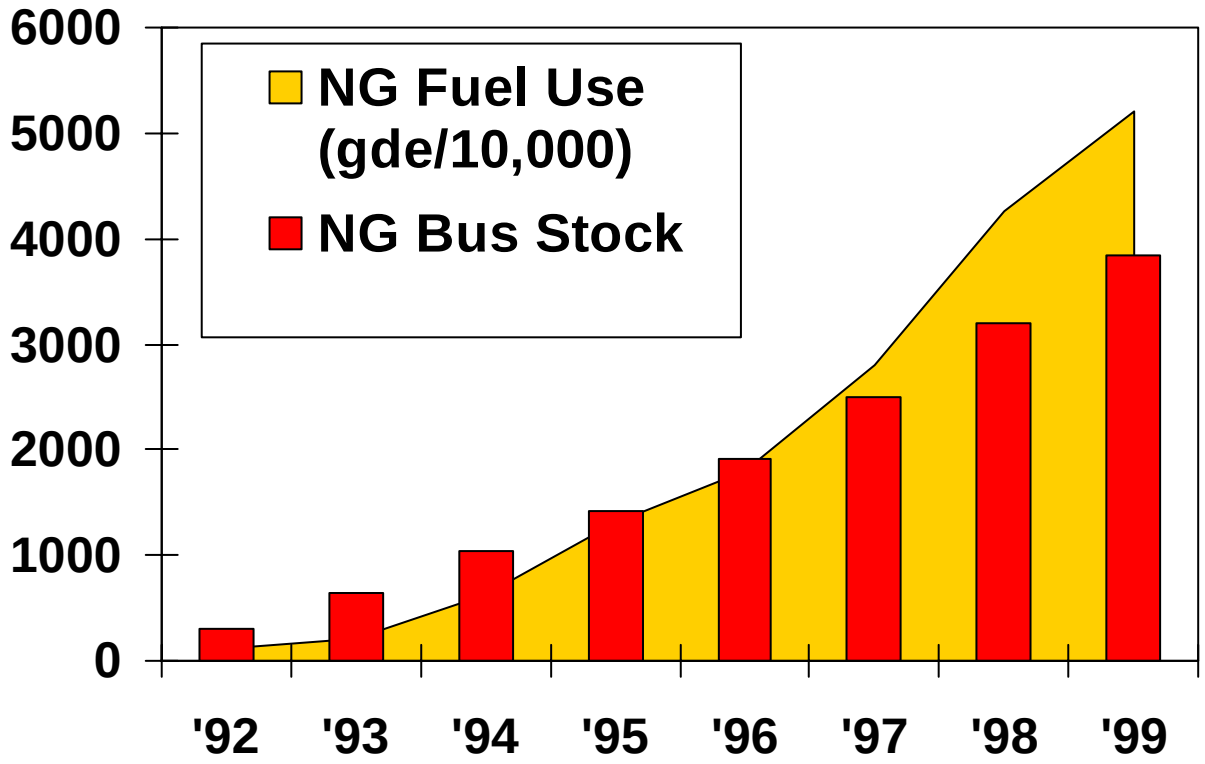
  versus diesel, based on emissions testing and certification data

Alternative Fuel Bus Stock Continues to Grow



Source: APTA Transit Vehicle Data Book

NG Fuel Use Outpaces Increase in NG Bus Stock



Source: APTA Transit Vehicle Data Book

Natural Gas Bus Production by Leading Manufacturers

Company	NG as % of Total
Novabus	0.3%
Gillig	1.9%
Orion	36.1%
New Flyer	19.5%
North American	9.3%
Top 5 Total	22.2%

Transit Agencies with over 100 NG Buses

- Los Angeles, CA
- Houston, TX
- Garden City, NY
- Cleveland, OH
- Dallas, TX
- Phoenix, AZ
- NY, NY
- Sacramento, CA
- Atlanta, GA
- Tacoma, WA

In 1999, 65 transit agencies operated NG buses

- 10 TA's operate over 100 NG buses
- 31 TA's run 20% or more of fleet on NG buses

School Buses

23 million children ride 442,000 school buses

- Thomas Built and Bluebird currently offer CNG models, conversions available for propane, electric
- CNG can reduce PM 80% NOx 40% versus a new diesel school bus (UCS)
- Possibly higher exposure to diesel exhaust inside school bus (NRDC)

Waste Collection Vehicles

Forthcoming INFORM report (Fall 2001) to investigate:

- Resource recovery "closing-the-loop"
  - Biodiesel from waste vegetable oils
  - Biogas – waste methane recovered from landfills
- CNG & LNG demonstration programs – US, Europe, Japan
- Potential for HEV, FCV technologies

AFV Conclusions

- Cleaner alternative to heavy-duty diesel
- Reduced consumption of foreign
- Often commercially available as OEM products
- Infrastructure a major barrier – possibility for on-site steam reforming of CNG to H2
- Consensus growing on health impacts of diesel exhaust